REMARKS

Status of Claims

Claims 1-11 remain pending in their form resulting from Applicants' amendment dated August 12, 2005 in the present application. In particular, Claims 1 and 2 were amended for editorial clarity, while claims 3-11 were left in their original form as filed.

Response to Arguments

Below is an outline of the points made in the Office action in an attempt to dismiss Applicants' arguments in their reply of August 12, 2005, followed by Applicants' comments regarding each point.

A. The Office action alleges that Applicants argue against the Srinivasan and Akahane references individually, which is of no avail in trying to overcome a nonobviousness rejection.

   - On the contrary, Applicants respectfully submit that the gist of their arguments is directed toward the *combination* of Srinivasan and Akahane, not to the references individually. In particular, the gist of their arguments is that Srinivasan is not directed to, and indeed seems to teach away from, the point defect geometry taught by Akahane et al. Accordingly, there is no motivation in Srinivasan to combine the teachings of Akahane et al. with those of Srinivasan.

   - The rejections in the first Office action on the merits, and the rejections, addressed below, in this final action are based on Akahane et al. *in view of* Srinivasan. Therefore, the Office should have pointed out a motivation in Akahane et al. to combine the teachings therein with the teachings of Srinivasan. Instead, however, Srinivasan alone has been cited—specifically page 673, section 3, line 3, and line 6 of the abstract on page 670—as a motivation to combine the teachings of the two references. It is respectfully submitted that for at least this reason, the rejections in this and the first Office action are improper.

   - That is, the Office has not made a *prima-facie* showing of a motivation in *Akahane et al.* to combine the teachings therein with those of Srinivasan.

   - Conversely, It is respectfully submitted that the reason the Office has not rejected this application over Srinivasan in view of Akahane et al. is indeed

because there is no motivation in Srinivasan to turn to the teachings of Akahane et al.

B. The Office alleges that Applicants' argument was that "Srinivasan never teaches point defect geometry."

- That allegation is false. Applicants' argument was that Srinivasan does not teach the point defect geometry as claimed in the present application, *not* that Srinivasan *never* teaches point defect geometry of any kind.

C. The Office alleges that Applicants' argument—made in the last paragraph on page 7 through the second paragraph on page 8 of their August 12, 2005 reply that Srinivasan teaches away from combining the Srinivasan teachings with those of Akahane et al. is not persuasive because

> Srinivasan does not teach that the present modification, set forth in applicants' claims, leads to the destruction of the invention of Akahane

(page 3, second paragraph of the final Office action).

- Applicants' argument that Srinivasan teaches away from combining with Akahane et al. was simply meant to assert that the teachings in Srinivasan lack such a motivation to combine. Applicants' argument was *not* that Srinivasan teaches that a device combining the teachings of the two references (the "present modification," in the words of the Office action) would be inoperable, which is what the Office seems to be saying in writing of the "destruction" of the invention of Akahane et al.

D. The Office alleges that any hindsight reasoning that Applicants stated may have been used in the first Office action is only based on the knowledge of a person skilled in the art, not based on knowledge gained from the present specification.

- Nevertheless, in making this allegation the Office continues only to insist "Srinivasan teaches that the geometry of a point defect can be dimensionally altered in order to reduce radiation loss." But that misses the point of Applicants' argument, which was that Srinivasan is silent as to the defect geometry of Akahane et al.; consequently an assertion that it would be obvious to combine the teachings of the two references must indeed benefit from reasoning gained in hindsight by studying the present specification.

Claim Rejections under 35 U.S.C. § 103

<u>Claims 1-11; Akahane et al. (*Applied Physics Letters*) in view of Srinivasan and Painter (*Optics Express*)</u>

Claims 1-11 have again been rejected as being obvious over Akahane in view of Srinivasan.

This portion of the final Office action is essentially a verbatim repetition of the § 103 rejections made in the first Office action. There are only three slight differences:

(1) In the last line of the second paragraph on page 5 the words, "The motivation would have been" have been added in front of "to reduce vertical radiation loss in the slab."

- Yet although this may clarify that the Office is alleging a motivation to combine, that motivation in the first place is in Srinivasan, not Akahane. As noted above in discussing the response to arguments, the claim rejections are based on Akahane *in view of* Srinivasan, which underscores that this motivation in Srinivasan is not a motivation to turn to the teachings of Akahane.

(2) In repeating the rejections of the dependent claims, the words "in view of Srinivasan" have been inserted in between the words "Akahane teaches."

- Yet thus inserting the words "in view of Srinivasan" does not amount to a *prima-facie* showing of a motivation in *Akahane et al.* to combine the teachings therein with those of Srinivasan.

(3) At the end of the paragraph rejecting claim 10, the sentence, "The motivation would have been to increase the Quality factor of the filter" has been added.

- While this is the one instance in which the examiner has pointed out from Akahane et al. an alleged motivation to combine the Akahane et al. teachings with those of Srinivasan, it is respectfully submitted that it does not amount to a *prima-facie* showing of a motivation in *Akahane et al.* to combine the teachings therein with those of Srinivasan.

In short, the Office has not made a *prima-facie* showing of a motivation to combine the Srinivasan and Akahane et al. references. The Office has neither shown such a motivation in Akahane et al., which properly is required, since the Akahane et al. is the primary reference for the § 103 rejections, nor has the Office explicitly shown in Srinivasan a motivation concerning the point defect geometry taught in Akahane et al.

Nevertheless, in the following, Applicants present further arguments to the effect that neither reference puts forward a motivation to combine the teachings of the other in such a way as would arrive at the present invention.

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Summarizing the structure of a point-defect cavity of the present invention—namely, altering the size of holes that are nearest neighbors to a point defect—points out, first of all, utter difference from the graded cavity of Fig. 7(a) in Srinivasan et al. Below, as reasons leading to the differences between the present invention and Srinivasan et al., Applicants set forth that it is because the concept by which the point-defect cavity structure was arrived at is quite different.

Graded cavity (Srinivasan et al.): designed using the perturbation theory. Accordingly, Q value can only be increased by, for the most part, chance—moreover, by altering the size of a very large number of air holes. In other words, the idea that increasing Q value is possible simply by altering the size of the nearest-neighbor holes could not be surmised in the least by this method alone. Furthermore, inasmuch as the perturbation theory is not applicable to the point-defect cavity of Akahane et al., the present invention cannot be derived from concepts utilizing the perturbation theory.

Alteration of nearest-neighbor hole diameter (present invention): conceptualized through an idea completely separate from the graded cavity concept.
It is true that Srinivasan et al., on page 673, section 3, line 3, state, "the geometry of the defect and the surrounding holes can be tailored to reduce . . . [radiation loss]," (that is, to raise the Q value). Nevertheless, the three examples illustrated therein—(1) Table 6, (2) Table 7, and (3) Fig. 7(a)—totally differ from the defect structure of Applicants' present invention, and thus it would be impossible without inventive effort to derive the defect structure that Applicants have invented.

Now this discussion will look at a specific comparison. The structure Applicants have invented is tantamount to one in which, with a defect in which three or more holes are filled (e.g., defect L3 in the Akahane paper from *Applied Physics Letters*) as a base, "the geometry of the surrounding holes has been tailored." Of the three types of defects set forth in the Srinivasan et al. paper, the one that corresponds to a defect structure in which "the geometry of the surrounding holes has been tailored" is the structure of Fig. 7(a), but that defect configuration is, in the first place, realized by the graded alteration of the size of very many holes.

Accordingly, although at the end of page 5 the Office action asserts, "However, the above reference to surrounding holes taught by Srinivasan can reasonably be interpreted as applying to secondarily adjacent lattice points," it is respectfully submitted that the Srinivasan configuration entails as a necessary condition a graded

cavity in which, "the immediate-neighbor holes are enlarged in radius, and "[t]he hole radii are then increased parabolically outwards for 5 periods in the x direction and 7 periods in the y direction, after which they are held constant," as quoted in Applicants' reply of August 12, 2005.

In contrast, the defect configuration invented by Applicants requires only that the holes that are varied in diameter be those that are nearest neighbors to the defect, which differs completely from the graded-cavity structure of Fig. 7(a) in Srinivasan et al. Put another way, the structure that would result from merely combining the knowledge of Srinivasan et al. with the knowledge of Akahane et al. would be an L3-defect graded cavity, which is completely different from the defect structure that Applicants have invented. In short, to a person skilled in the art who has learned both the knowledge in Srinivasan et al. and the knowledge in Akahane et al., the defect structure that Applicants have invented could not be arrived at without inventive effort.

Applicants therefore urge, in anticipation of a converse rejection of the present claims, that the Srinivasan paper in the first place would *not* motivate a person skilled in the art to apply the Srinivasan principles to a defect geometry as taught by Akahane et al., but even if the Srinivasan paper could so motivate a combining of the teachings of the two papers, the result would not be the present invention.

Also, the reason why the defect structure that Applicants have invented differs completely from a graded cavity structure—that is, the reason giving rise to the differences as to the number holes that are altered in size, and as to the presence/absence of a graded configuration—is because the idea leading to the present invention is totally different. First, what led Srinivasan et al. to hit upon their graded cavity structure is based on the perturbation theory. Specifically, the theory is one in which, starting from a photonic crystal slab, the importation of defects is treated as perturbation in the dielectric, and then the cavity configuration is determined during a process of trial and error by performing a Fourier transform on the perturbation to evaluate whether the leaky components have increased. This technique cannot serve as a guide to get at the heart of where and in what way is best to alter the cavity structure. In other words, the result of trial and error is for the most part fortuitous; moreover, a cavity having a high Q value can only be obtained by altering the geometry of extraordinarily many air holes.

Thus, the concept of realizing a high-*Q* nanocavity simply by changing the size of the nearest-neighbor as well as the second nearest neighbor air holes would not come to mind from design techniques based on the perturbation theory. In the Srinivasan et al. instance, actually, the structure that happened to prove satisfactory was ultimately a graded cavity structure, differing completely from alteration in the size of the defect's nearest-neighbor holes. To elaborate further, the perturbation theory only holds when the amount of perturbations is slight. Thus, inasmuch as this theory

cannot be applied to a defect according to the Akahane paper—that is, a defect in which the air holes are completely filled—the defect configuration that Applicants have invented could not be produced from this theoretical construct.

Applicants respectfully urge that as set forth above, the point defect cavity structure that Applicants have invented clearly differs from the graded cavity structure of Srinivasan et al. and is sufficiently non-obvious over that structure.

Applicants also add that in their present invention, the fact that the number of holes whose size is altered is slight compared with a graded cavity is desirable from both design and fabrication standpoints, which is exactly what Srinivasan et al. note, in the paragraph immediately preceding section 6 on page 684 of the reference, would be the case. Applicants believe that the very considerable importance of their present invention will be understood from such practical perspectives as well.

A response to this Office Action was due by January 31, 2006, and consequently a Petition for Extension of Time, along with a credit-card payment authorization form, is attached hereto. Please consider this Amendment as timely filed.

Accordingly, Applicant courteously urges that this application is in condition for allowance. Reconsideration and withdrawal of the rejections is requested. Favorable action by the Examiner at an early date is solicited.

Respectfully submitted,

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